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Adipose-derived mesenchymal stem cell application combined with fibrin matrix promotes structural and functional recovery following spinal cord injury in rats

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2018 Mukhamedshina, Akhmetzyanova, Kostennikov, Zakirova, Galieva, Garanina, Rogozin, Kiassov and Rizvanov. The use of stem and progenitor cells to restore damaged organs and tissues, in particular, the central nervous system, is currently considered a most promising therapy in regenerative medicine. At the same time, another approach aimed at stimulating regeneration with the use of stem cells encapsulated into a biopolymer matrix and capable of creating a specific microenvironment for the implanted cells similar to the natural extracellular matrix is under active development. Here, we study effects of the application of adipose-derived mesenchymal stem cells (AD-MSCs) combined with a fibrin matrix on post-traumatic reactions in the spinal cord in rats. The AD-MSC application is found to exert a positive impact on the functional and structural recovery after spinal cord injury (SCI) that has been confirmed by the results of behavioral/electrophysiological and morphometric studies demonstrating reduced area of abnormal cavities and enhanced tissue retention in the site of injury. Immunohistochemical and real-time PCR analyses provide evidence that AD-MSC application decreases the GFAP expression in the area of SCI that might indicate the reduction of astroglial activation. Our results also demonstrate that AD-MSC application contributes to marked upregulation of PDGFßR and HSPA1b mRNA expression and decrease of Iba1 expression at the site of the central canal. Thus, the application of AD-MSCs combined with fibrin matrix at the site of SCI during the subacute period can stimulate important mechanisms of nervous tissue regeneration and should be further developed for clinical applications.

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Keywords

Adipose tissue, Fibrin matrix, Mesenchymal stem cells, Rats, Spinal cord injury

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